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# KENSLEYRAO APAJEE'S OPEN TEXTBOOK JOURNEY

**Bianca Masuku, Michelle Willmers, Henry Trotter & Glenda Cox**

**Grantee:** Kensleyrao Apajee
**Position:** Head Tutor / MPhil student
**Department:** Mechanical Engineering
**Faculty:** Engineering and the Built Environment
**Course**: Engineering Drawing
**Degree level:** Undergraduate
**Title of initiative:** First-Year Mechanical Engineering Drawing
**Title of envisioned open textbook:** *Sketching, Drawing and Visualisation for Engineers*

## Introduction

Can you imagine being a South African university student and having to pay R2,000 for a one-semester engineering drawing textbook where all the measurements in the book are referenced in inches, feet, yards and miles … and you only use a portion of the textbook? It doesn't make sense.

That was the reality Kensleyrao 'Kensley' Apajee faced as the Head Tutor in the first-year Engineering Drawing (ED) course in the Faculty of Engineering and the Built Environment at the University of Cape Town (UCT) from 2017–2019. The issue arose from the textbook selected for the course which forced students to choose between buying an expensive and (perhaps) ill-suited textbook or ignoring it at their peril. He thought there must be a better alternative, so he set his mind to creating one in the form of an open textbook.

Hailing from Mauritius, Kensley had developed a passion for teaching and planned to create some free, locally relevant resources to replace, or complement, the prescribed textbook for the ED course. This effort would be part of his MPhil in Engineering Education at UCT. When he heard that the Digital Open Textbooks for Development (DOT4D) project was offering grants for open textbook development, he applied and won a grant in 2019 to develop a first-year mechanical engineering drawing open textbook under the guidance of his MPhil supervisor, Dr Bruce Kloot.

What follows is a story that is both inspiring and frustrating. It combines all the ups and downs you would expect of any difficult, yet worthwhile, journey. Anyone interested in open textbook production will want to read on.

**The Digital Open Textbooks for Development (DOT4D) project is a research, advocacy and implementation initiative based in the Centre for Innovation in Learning and Teaching at the University of Cape Town (UCT). From March 2018 – March 2019, 11 open textbook initiatives received DOT4D grant funding at UCT. The Open Textbook Journeys series tells the stories of the people driving these initiatives, their teaching and publishing processes, and what inspires them to do this work. These case studies were developed in collaboration with and reviewed by the open textbook authors profiled.**

This case study draws on:

- Kensley's grant proposal to the DOT4D project.
- Kensley's grant report to the DOT4D project.
- Field notes of the DOT4D Publishing and Implementation Manager.

## What is the problem Kensley is trying to address?

All mechanical engineering students at UCT take the ED course in their first year. Only a small portion of them are exposed to engineering drawing or engineering graphic design in secondary school; thus most have no prior experience with this kind of technical drawing, which is critical for the development of spatial visualisation ability (SVA). SVA is a skill which has been shown to be a predictor of success in science, technology, engineering and mathematics (STEM) fields (Khine, 2017).

The path to greater proficiency in technical drawing is complicated at UCT, however, by the fact that students are taught this new discipline in English, which is a second or third language for many. They do so in a class with about 150 other students, making it difficult for some to receive the attention they might need from teaching staff. And only a minority of students can afford private tutoring to get around these issues.

These challenges are compounded by the high price of the prescribed textbook for the course, *Fundamentals of Graphic Communication* (Bertoline, Wiebe, Hartman & Ross, 2011). In July 2020, the book cost $125 (R2,000) on Amazon[1]. Most students would think twice before spending that much money on a book that is prescribed for just one semester, and of which (according to Kensley) they will only use 10% during the course.

While UCT Libraries stocks other ED textbooks (as well as copies of older editions of the prescribed textbook), they are not sufficient to meet students' needs. Furthermore, the prescribed American textbook lacks relevance for certain aspects of the South African context. It uses imperial measurements (feet, inches) rather than metric. It presents different types of projection, line styles, dimensional standards and lettering standards than are locally used. And it is geared more for draughtspersons studying at technical schools rather than university-level mechanical engineering students.

[1] https://www.amazon.com/Fundamentals-Graphics-Communication-Robert-Bertoline/dp/0073522635

The prescribed American textbook lacks relevance for certain aspects of the South African context

Because of these issues, Kensley estimated that less than a dozen of the 150 students actually bought the textbook. Thus, they were faced with significant pedagogical and financial challenges in trying to succeed in this critical discipline.

## Textbook conventions in the discipline

Kensley indicated that in mechanical engineering courses at UCT, lecturers largely decide which educational resources they use. For in-class instruction, he stated, 'most of the lecturers have their own slides…some get it from other places….Most of them have some good resources'. The selection and combination of these materials is often the result of years of experimentation and adjustment while teaching.

For at-home readings and assignments, lecturers may ask students to draw on materials from a tailored reading pack, a reference textbook, or materials that they themselves must search for on the internet or at the library.

## Kensley's open textbook journey

### Original plan

Through his experience as a tutor at UCT, Kensley came to believe that an open textbook focused on the practical elements of engineering drawing in the South African context could not only address the learning needs of local students – especially as they relate to the development of their SVA – but do so in a manner that was financially viable for them.

Before even hearing about the DOT4D grants programme, Kensley started compiling ideas in 2018 of what he thought should be included in a resource for supporting student learning. He wanted something that would reassure ED students and lighten their load a little. Using Scribus open-source desktop publishing software, he produced a few pages of his own personal writing for the first two modules of the course, which

included the main theory and explanation and a couple of worked examples. He also developed some material on SVA (which is not a formal course component, but nonetheless crucial for drawing proficiency) and made all of these materials available to the students from the start of the first semester of 2019. This work formed part of his MPhil project.

In formulating his teaching approach, Kensley drew on the work of scholars who identified numerous challenges students encounter in engineering drawing, including teaching approach, acquisition of fundamental knowledge of the subject in secondary education, the learning atmosphere and time allocated. Kensley felt that, step by step, each of these factors could be addressed so as to make the learning experience a much better and more fruitful one.

When Kensley was awarded the DOT4D grant in 2019 for developing a *Sketching, Drawing and Visualisation for Engineers* open textbook, it was conceived as a means to support the formal tutorial process by taking students on a journey of acquiring the necessary practical drawing skills.

> Kensley aimed to design a resource that was freely accessible to UCT students, containing learning materials adhering to South African drawing standards

To do this, Kensley aimed to design a resource that was freely accessible to UCT students, containing learning materials adhering to South African drawing standards. It would be locally relevant, using appropriate measurement units, projection types, line styles, dimensional standards and lettering standards. And it would be aimed at South African university students, complementing their journey through the mechanical engineering degree.

The intention was for the textbook to be made freely available online under a Creative Commons licence. While aimed at the UCT students, it would be available for anyone in South Africa who wished to learn ED and hone their SVA skills. It would also fill a gap in the South African market, in that there were no similar resources that sought to develop ED skills while enhancing the SVA of students.

Kensley hoped that the book would make a highly technical subject like ED more accessible and enjoyable to first-year students, particularly those who had not been exposed to it prior to university.

## Authorship approach

Kensley adopted a ‘solo student author with UCT intermediary support’ authorship approach, in which he envisioned that he would be the sole author of the book, conceptualising, designing and producing the text and graphics by himself. For the most part, this was the case.

He embedded his authorship approach in the ED course teaching and tutoring framework. As part of his MPhil work, and as a precursor to the full open textbook development process, he developed three prototype chapters to support topics which were being taught at the time. He consulted with the course lecturer to ensure that his content was adequate and appropriate to support the knowledge conveyed in class. When he had a draft chapter ready, his MPhil supervisor reviewed the content, after which additional edits were made and a preliminary chapter layout was completed.

These preliminary chapters formed the foundation for a more thoroughly conceptualised open textbook, the development of which was undertaken with the DOT4D grant. From that point onwards, Kensley worked with the DOT4D Publishing and Implementation Manager (PIM) who provided assistance in the form of editorial and production support.

## The content development process and student involvement

Kensley was able to trial three prototype chapters with the students over the course of one semester. They, in turn, gave him useful feedback (via a survey he sent to them) at the end of the term, which shaped later iterations of the book.

The main suggestion they offered was that he should include more practice exercises. Kensley acknowledged that this made sense, as ‘drawing is best learnt through drawing itself’. Thus, instead of going into great detail regarding the theory underlying the different topics, he provided concise summaries for each of them, freeing up more space for an emphasis on worked examples and practice exercises. Through the expanded practice opportunities in the updated version of the textbook, he hoped that students would develop not only greater insights into ED, but also become highly proficient in drawing.

## Publishing process

**Prototyping (pre-DOT4D grant period, 2018/2019)**
Three chapters were developed and trialled with students in tutorials. Kensley's supervisor, Dr Kloot, provided input on the chapters during this phase.

**Pre-production / editorial development (DOT4D grant period, March 2019 – February 2020)**
Seven draft chapters were developed. The PIM proofread all chapters and provided guidance on editorial approach, cohesion in chapter structure and integration of visual elements.

**Production (envisioned)**
The next step was to finalise all 11 chapters (as per the proposed table of contents) and move to the layout phase, at which point the PIM would support with layout advice and page-checks. Kensley produced a sample layout for one chapter, on which the PIM provided feedback.

**Publication (envisioned)**
As the production process has yet to be completed, the publishing process remains in incubation.

## Content development and publishing tools

Kensley wrote the textbook content in MS Word, managed image production in Adobe Photoshop and created the page layout in Adobe InDesign.

## Copyright and licensing

As an aspiring graphic artist and illustrator, Kensley produced all of his own images for the textbook, therefore he did not anticipate any copyright or licensing issues.

The aim was to release the final published textbook under a Creative Commons Attribution 4.0 International licence, with Kensley being the sole author and copyright holder.

## Quality assurance and sustainability

In terms of quality assurance, Kensley anticipated that he would call on academics and professionals in the engineering drawing field as well as educational and pedagogical experts to review chapters and advise on how to optimise the book and the publishing process. In the prototype phase, quality assurance was provided by Kensley's MPhil supervisor, a lecturer in mechanical engineering at UCT.

In the DOT4D grant phase, as the textbook development progressed, Kensley worked closely with the DOT4D PIM, who played the role of editor for the book. It was envisioned that Kensley's supervisor would continue his quality assurance role in the later stages of the production process when typeset pages were produced.

> The survey, which was given to students after the first semester prototype implementation provided feedback on the efficacy of the materials and informed the content included in the chapters

In addition, the survey, which was given to students after the first semester prototype implementation provided feedback on the efficacy of the materials and informed the content included in the chapters still under development.

The original ambition was that once the full open textbook was produced, Kensley would continue to update the book in line with new advances and developments in the field so as for it to remain fit for purpose.

## Status at grant closure

At the end of the grant period (February 2020), 90% of the book's textual and graphic content was ready to be laid out according to the finalised designs and themes. Kensley had aimed to complete his textbook production and publishing process by the end of 2019 for implementation in the first semester of 2020, but that period turned out differently than he had hoped. At that time, Kensley was juggling multiple commitments as a member of his department's teaching staff, as an emerging open textbook creator, and as a foreign student studying abroad. His visa to study in South Africa was not renewed, creating new stresses on top of what he was already coping with as he tried to finish his MPhil. In those circumstances, he put his open textbook production to the side, hoping to come back to it after the completion of his degree.

# Challenges experienced and lessons learned

## Finding the right tone

As Kensley engaged in his textbook development process, new issues and opportunities emerged.

> ‘The open textbook is an opportunity to leave a legacy of good drawing practices for the young engineers of tomorrow’

He initially wanted to write the text in a ‘spoken’ style – a more conversational approach that would reassure students who might feel intimidated by formal academic language. But he soon realised that listening to someone speaking versus reading someone’s spoken words are not the same.

With the help of the DOT4D PIM, he tried to strike a balance between a colloquial spoken style and a formal academic tone that remained easy for students to understand.

### Technological assistance was critical

Because ED is, in essence, a graphic subject, when Kensley acquired a new laptop and digital drawing tablet through the DOT4D grant, he was able to enhance the quality of the pictorial elements included in the book. He could hand-draw concepts in a digital format without having to scan them from paper.

### It is impossible to anticipate all of life’s challenges

Kensley made good progress with his open textbook initiative within the parameters of the DOT4D grant period, but a number of administrative and temporal challenges arose which have – hopefully temporarily – stalled its progress. This does not mean that this open textbook journey is over for Kensley, just that it will have to move forward under different circumstances when he is able to do so.

### Kensley learned as much – if not more – than his students during this process

Kensley stated that his open textbook development process gave him great insight into the learning experience of students, and into himself as a teacher and individual. He said, ‘We, as teachers, are major stakeholders in the field of education. We should not only be aware but also be appreciative of the opportunity we have to inspire the younger generations to be better and happier members of our society. The open textbook, in my view, is therefore an opportunity to leave a legacy of good drawing practices for the young engineers of tomorrow and also keep up a bit of much-needed cheer in the classroom environment.’

## References


Bertoline, G., Wiebe, E., Hartman, N. & Ross, W. (2011). *Fundamentals of Graphic Communication*, 6th Edition. New York: McGraw-Hill Education.

Khine, M.S. (Ed.) (2017). *Visual-spatial Ability in STEM Education: Transforming Research into Practice*. Cham, Switzerland: Springer International.


## Budget

Overview of the original budget submitted to DOT4D as part of 2018 grant application, with actual expenditure.

**Budget projected at proposal phase**
Book content writing by main content creator: R19,500
Adobe software licence: R2,400

**DOT4D grant amount: R21,900**

**Project actual expenditure**
Adobe Creative Cloud package: R2,695
MSI PS42 Creative laptop: R18,900

**Total expenditure: R21,595**


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